**R15**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B.Tech II Year I Semester Examinations, May/June - 2019**
**MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE**
(Common to CSE, IT)

**Time: 3 Hours**                                                            **Max. Marks: 75**

**Note:** This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

### PART – A

(25 Marks)

1.a) Write converse and inverse for the statement "If Sun rises in the east then 3*7=98". [2]

  b) Express $(P \to Q) \wedge (P \leftrightarrow R)$ in terms of $\wedge$, $\vee$, ~ only. [3]

  c) Define LUB and GLB of a lattice and give examples for each. [2]

  d) Explain equivalence relation. Give suitable examples for a relation which is not equivalence relation. [3]

  e) In how many ways can 6 boys and 5 girls sit in a row? [2]

  f) Calculate the number of binary numbers with 9 one's and 5 zero's. [3]

  g) Write the characteristic equation for the following recurrence relation $a_n - 4a_{n-4} = 0$, $n \geq 4$ and solve it. [2]

  h) Find the generating function for the sequence $A = \{a_r\}$ where

$$a_r = \begin{cases} 2, & \text{if } 0 \leq r \leq 3 \\ 4, & \text{if } 4 \leq r \leq 5 \\ 0, & \text{if } r \geq 6 \end{cases}$$
[3]

  i) Give a general formula for Chromatic number of Cycle graph $\mathbf{C_n}$. [2]

  j) Find the Euler Path in the following graph 1. [3]
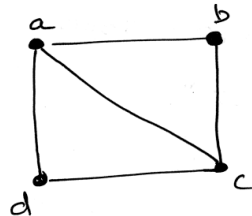


**Graph: 1**

### PART-B

(50 Marks)

2.a) Obtain principal conjunctive normal form (PCNF) for the formula $(\sim p \to r) \wedge (q \leftrightarrow p)$.

  b) Show that the following is inconsistent $P \to Q$, $R \to S$, $P \vee R$, $\sim (Q \vee S)$. [5+5]

**OR**

3.a) Using indirect proof, derive $P \to \sim S$ from $P \to Q \vee R$, $Q \to \sim P$, $S \to \sim R$, $P$.

  b) Show that $R \to (S \to Q)$, $\sim P \vee R$ and $S \Rightarrow P \to Q$. [5+5]

4.a) Explain properties of binary relations with examples.

  b) Draw the Hasse diagram for the partial ordering $\{(A, B): A \leq B\}$ on the power set e(S) where $S=\{a, b, c\}$ and $\leq$ is subset relation. [5+5]

**OR**

5.a) Draw the Hasse diagram for the divisibility on the set $\{1,2,3,6,12,24,36,48,96\}$.

  b) Define equivalence relation. Show that the relation *equal* on set of integers is equivalence relation. [5+5]

6.a) Write the 3-combinations and 3-permutations of {3.a, 2.b, 1.c, 3.d}.
  b) In how many ways can a committee of 5 teachers and 4 students be selected from 9 teachers and 15 students such that teacher A refuses if student B is in the committee. [5+5]

**OR**

7.a) Find the number of non negative integral solution for the equation $X_1+X_2+X_3+X_4=50$, where $X_1 >= 2$, $X_2 >= 4$, $X_3 >= -3$, $X_4 >= 7$
  b) Expand the multinomial $(X_1+X_2+X_3+X_4)^4$. [5+5]

8.a) Find the solution for the Fibonacci series $a_n=a_{n-1}+a_{n-2}$, $n \geq 2$ and $a_0=1$, $a_1=1$.
  b) Using substitution method, find the solution for $a_n=a_{n-1}+1/n(n-1)$ where $a_0=2$. [5+5]

**OR**

9.a) Solve the recurrence relation $a_n - 7a_{n-1} + 16a_{n-2} - 12a_{n-3} = 0$ for $n \geq 3$ with the initial conditions
$a_0=1$, $a_1=4$, and $a_2=8$.
  b) Find the solution for $a_n - 3a_{n-1} - 4a_{n-2} = 0$ for $n \geq 2$ and, $a_0 = a_1 = 1$. [5+5]

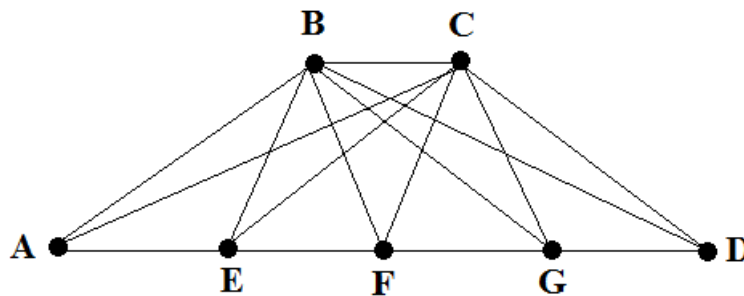10.a) Find the degree of each region in the following planar graph 2.
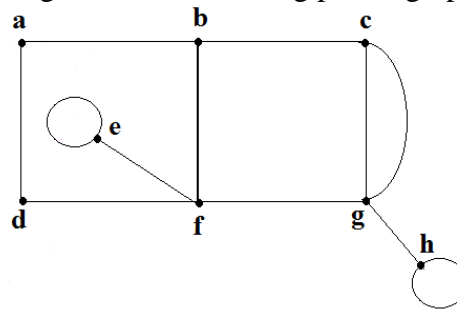


**Graph: 2**

  b) Show that the complete bi-partite graph $K_{3,3}$ is not planar graph. [5+5]
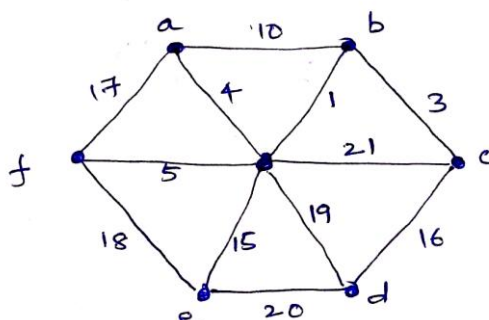
**OR**

11.a) Find the dual of the following graph 3.



**Graph: 3**

  b) Define spanning tree. Apply Prim's algorithm to find minimum spanning tree on the following weighted graph 4. [5+5]



**Graph: 4**

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